# Status of Fits Regarding Plug Door Simulations

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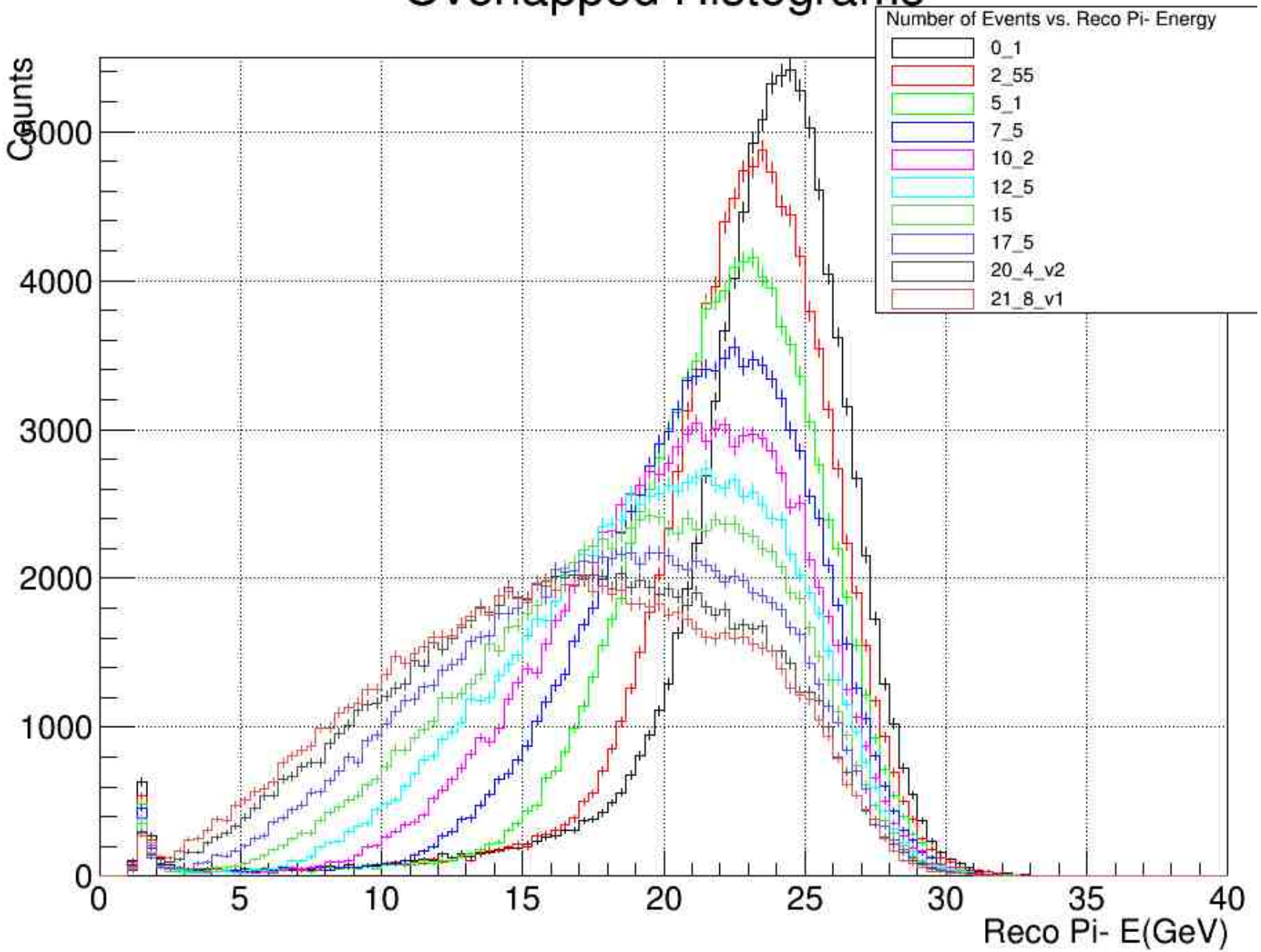
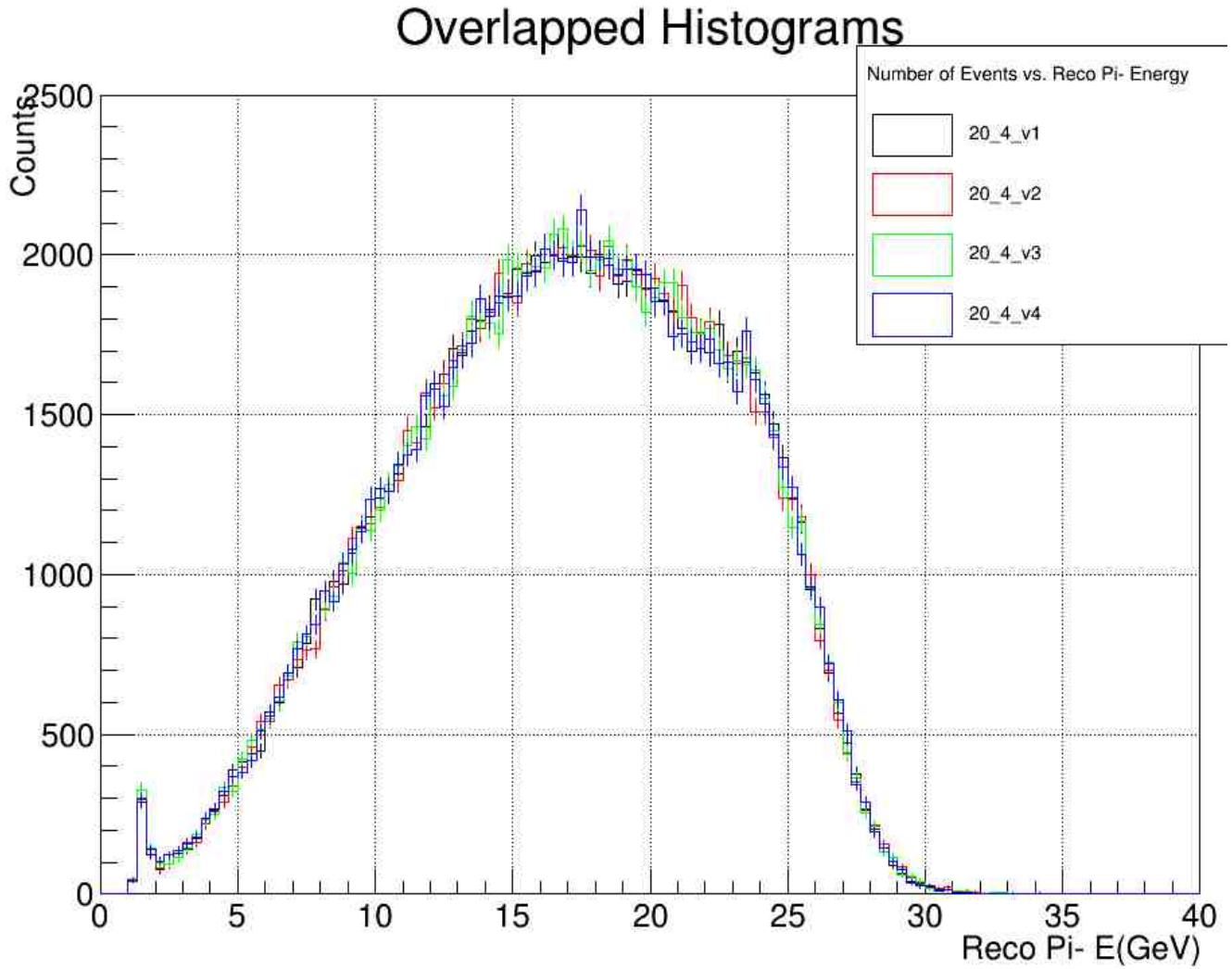
# Exploring Second Peak like structure in Reconstructed energy

- Noticed odd behavior at higher energies in the 20.4 cm thickness
- First started by checking overlap
  - No overlap without piston up to 21.85 cm
  - Loss of piston not an issue since only looking at η=2.0
- Reran 20.4 cm thickness 3 more times to check if statistical
- Ran 21.8 cm thickness 2 times as a check
- Also ran Thicknesses: 7.5, 12.5, 15.0, 17.5 once.
- The following histograms use the following convention in labeling
  - The underscore (“_”) character is equivalent to a dot (“.”) so “7_5” means a thickness of 7.5 cm

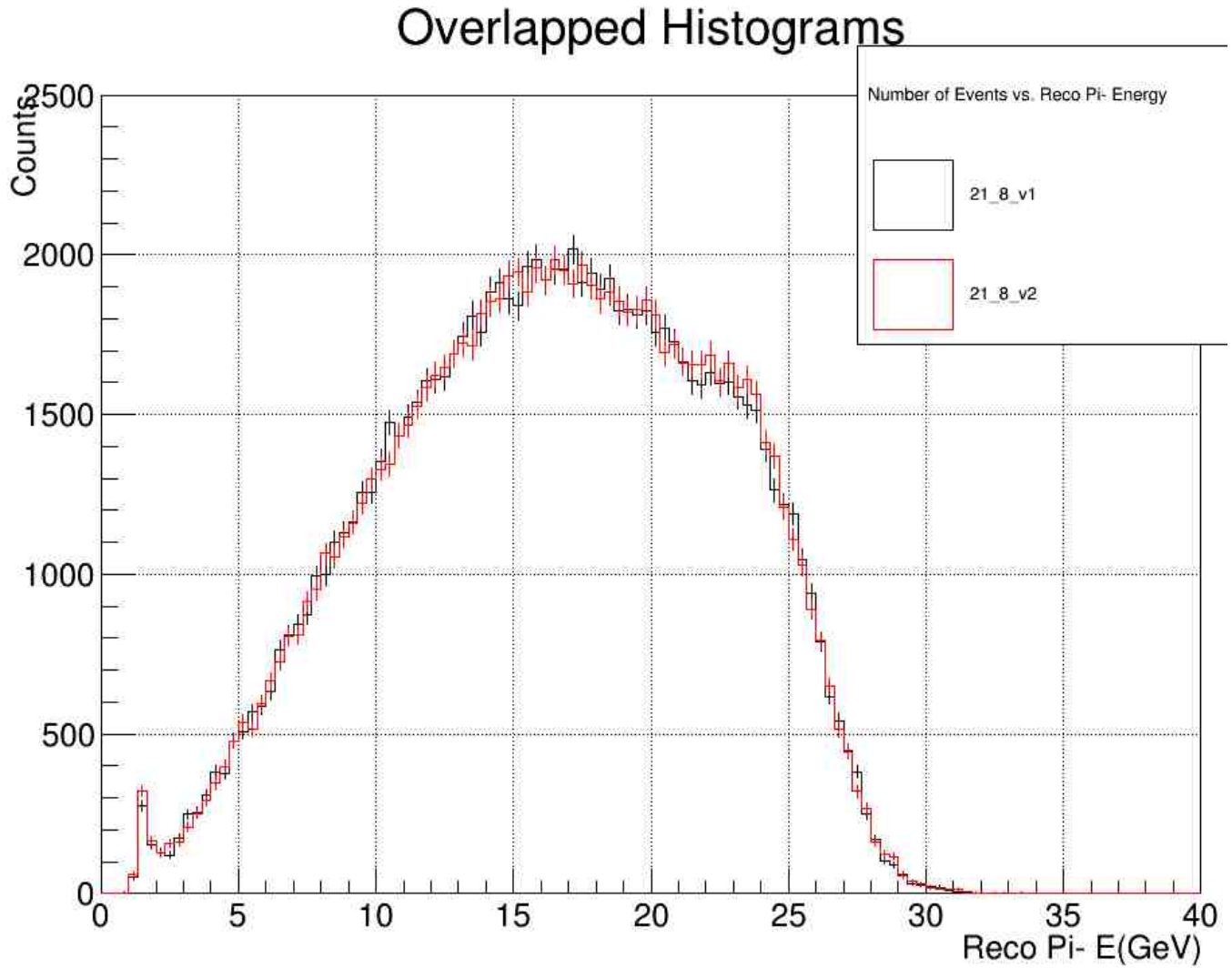
# Overlapped Histograms



# The 4 20.4 cm Histograms

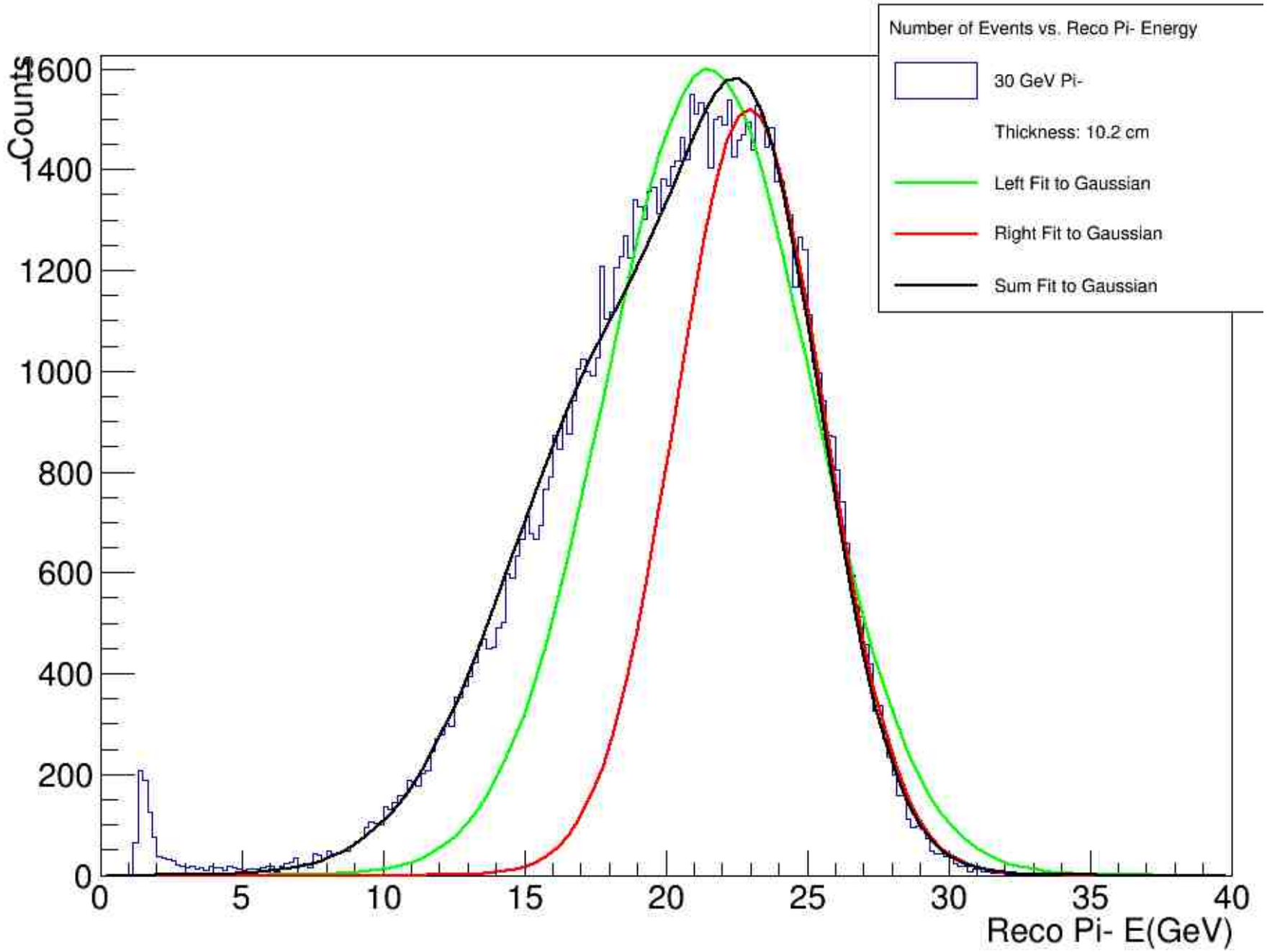


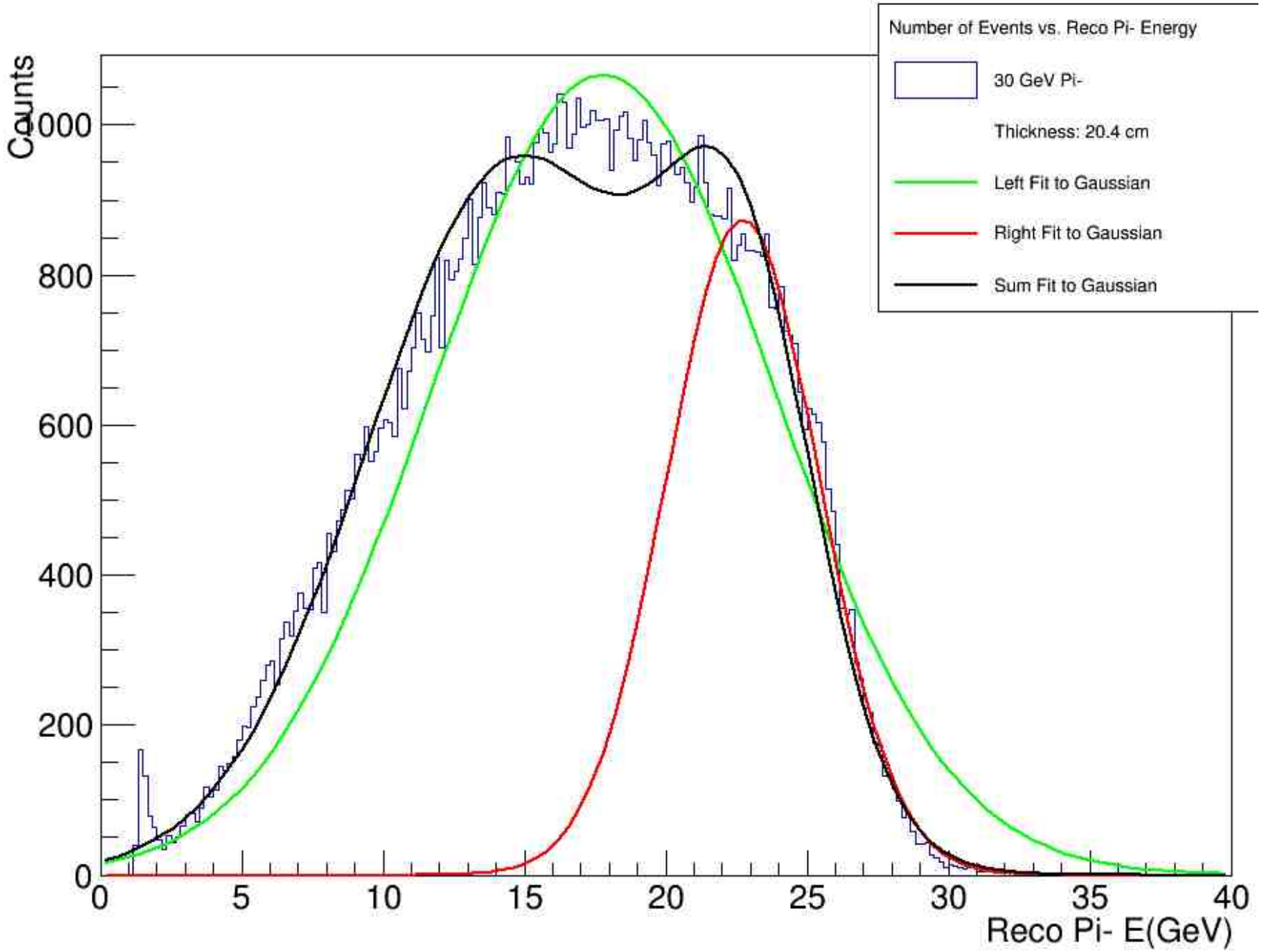
# The 2 21.8 cm Histograms



# Attempt at Fitting a Sum of Gaussians

- Tried to fit histograms to a sum of two Gaussians
- Seemed to work well for the 10.2 cm but not 20.4 cm
  - This could either be due to my fitting method or it may be that two Gaussians are not enough to describe the histograms
- There is a distinct “flatness” at larger thicknesses that seems very non Gaussian
- Probably not an issue since we are not making the door that thick but understanding it may explain why two Gaussians or more begin to appear


Number of Events vs. Reco Pi- Energy
30 GeV Pi-
Thickness: 10.2 cm
Left Fit to Gaussian
Right Fit to Gaussian
Sum Fit to Gaussian
Counts
0
200
400
600
800
1000
1200
1400
1600
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

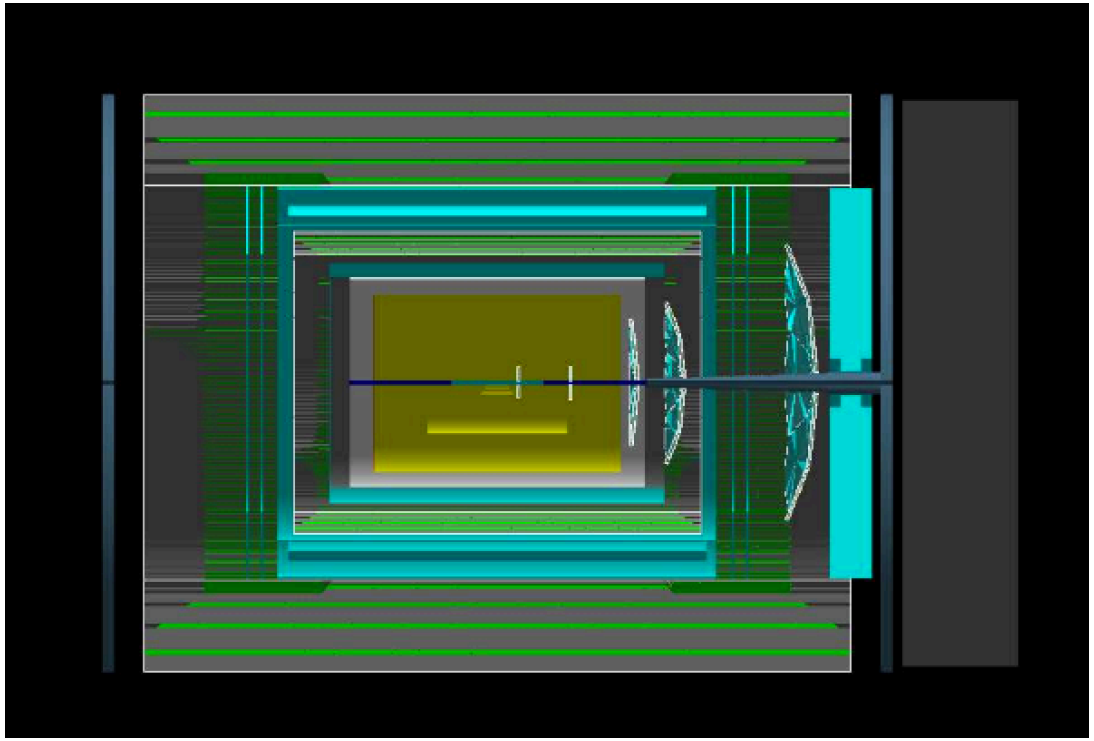

Number of Events vs. Reco Pi- Energy
30 GeV Pi-
Thickness: 20.4 cm
Left Fit to Gaussian
Right Fit to Gaussian
Sum Fit to Gaussian
Counts
0
200
400
600
800
1000
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

# Conclusions and Goals

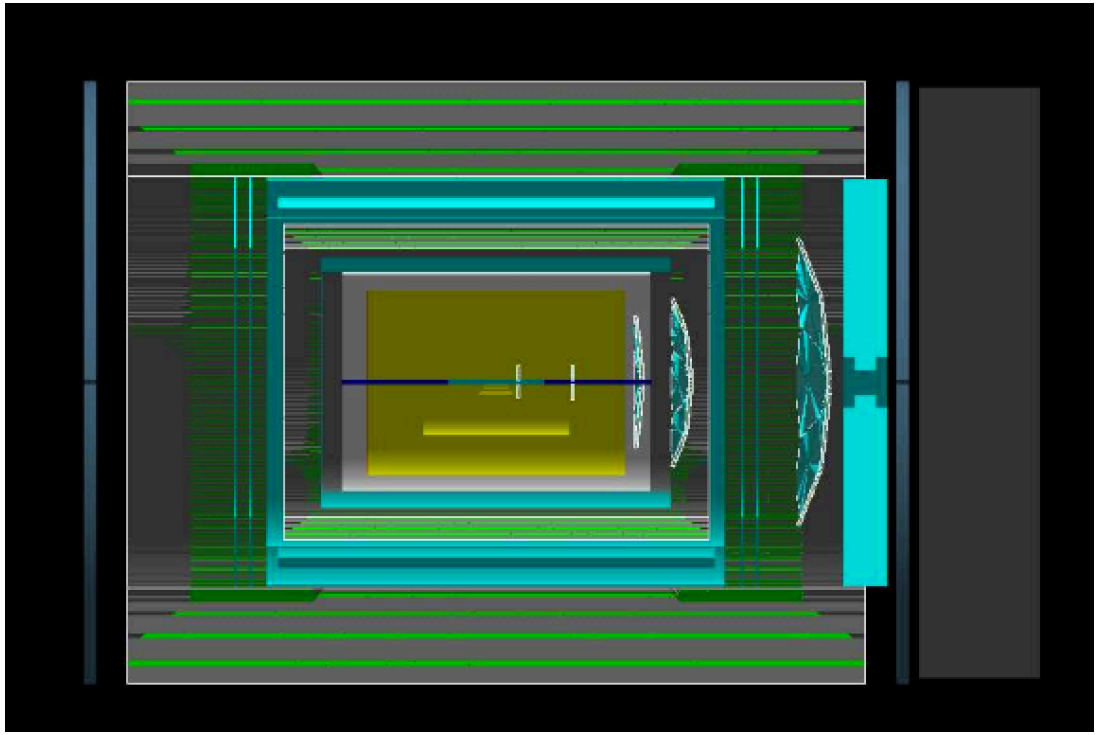
- The smearing seems to start at about 7.5 cm based on the histograms
- Based on the fit it seems the smearing in the 10.2 cm histogram can be explained by a second Gaussian.
- However for 20.4 cm it seems two Gaussians is not enough perhaps three may work better
- Possible reasons for strange behavior
  - Back scattering from plug door
  - Punch through plug door but not calorimeters
  - Particles showering in plug door?
  - Particles getting lost through scattering in the plug door
- May need to start looking at EMCAL, HCAL, and Black Hole energies individually to see where the energy is going.

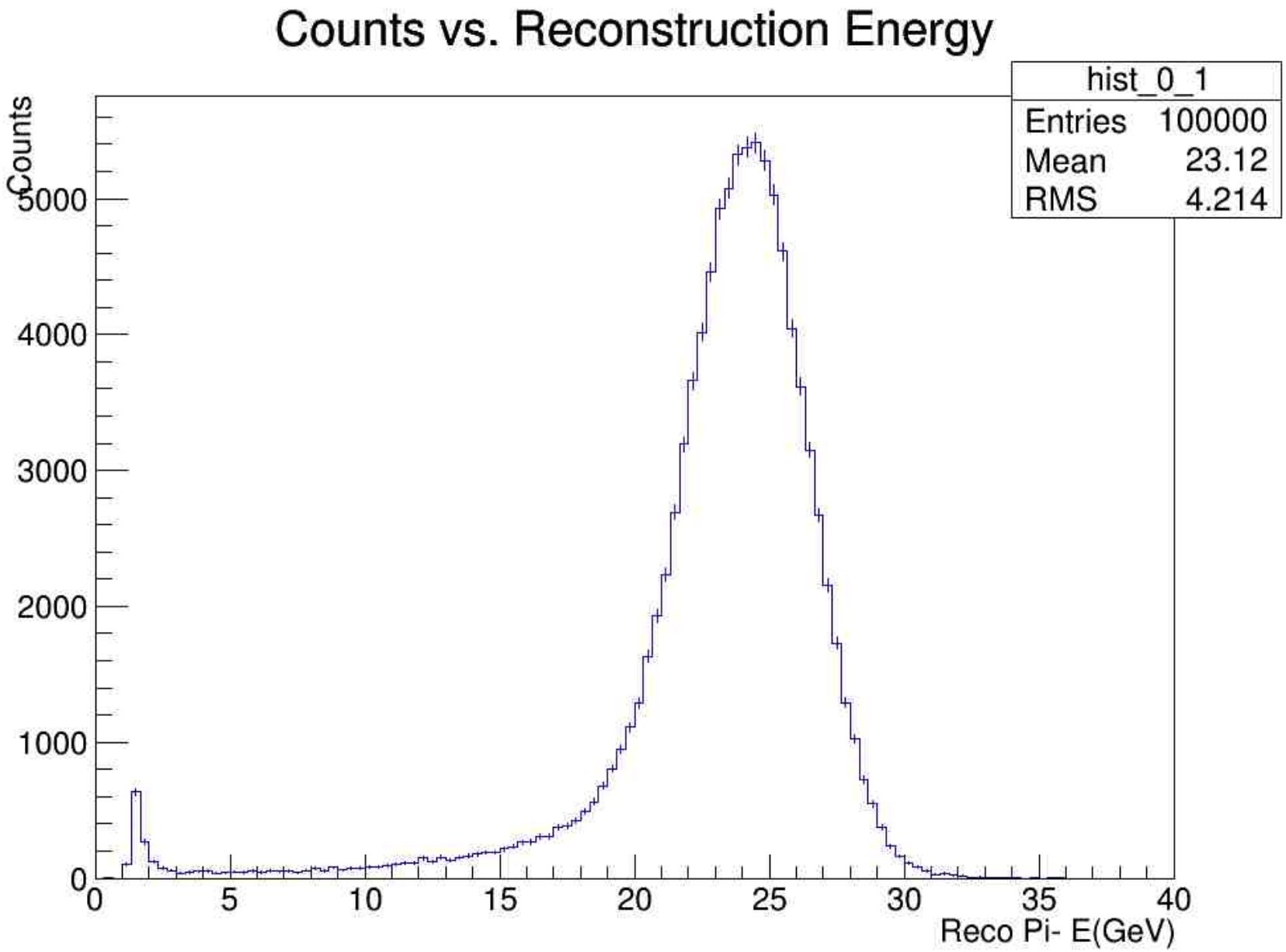
# Backup Slides

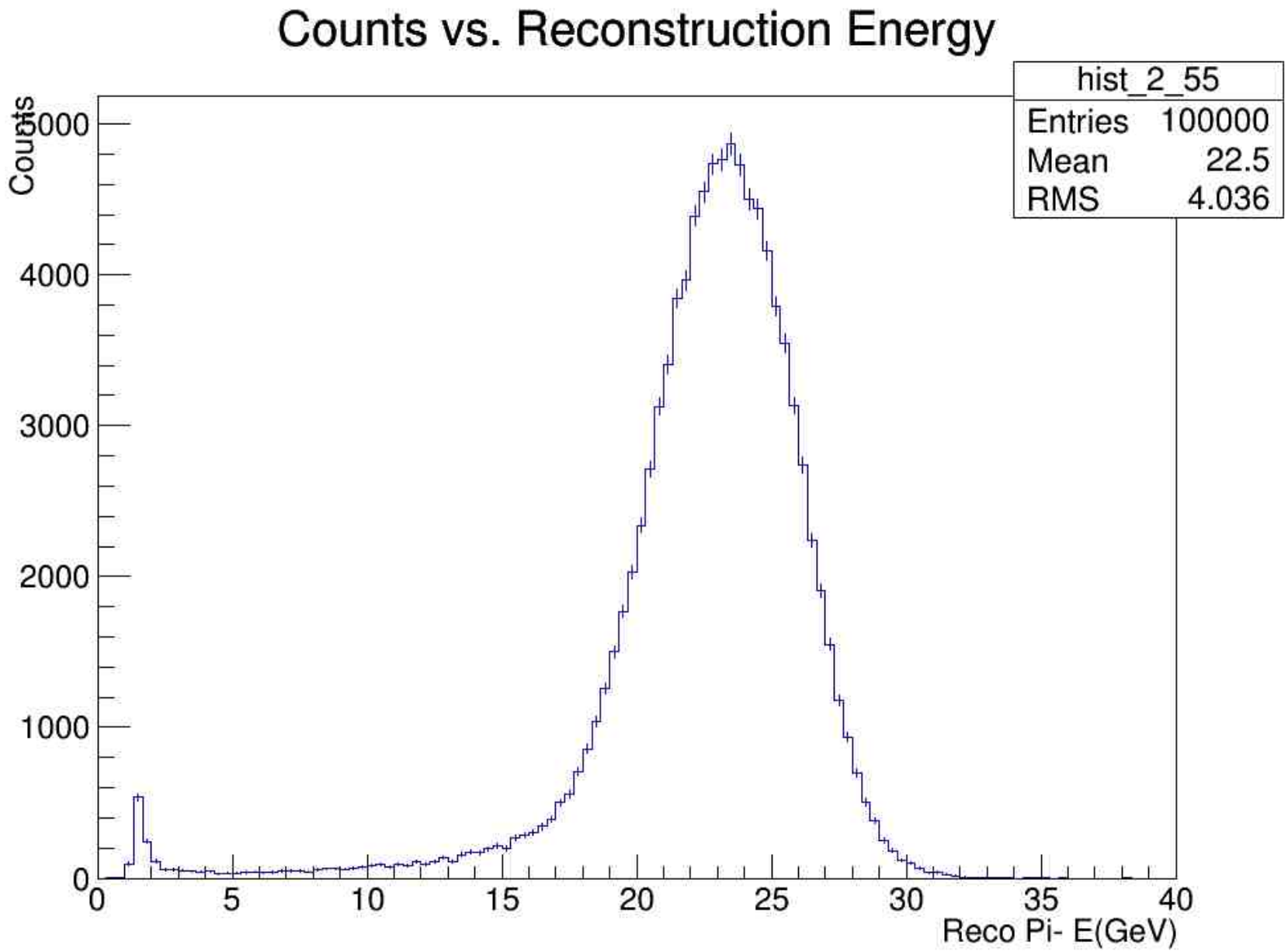
## With Piston

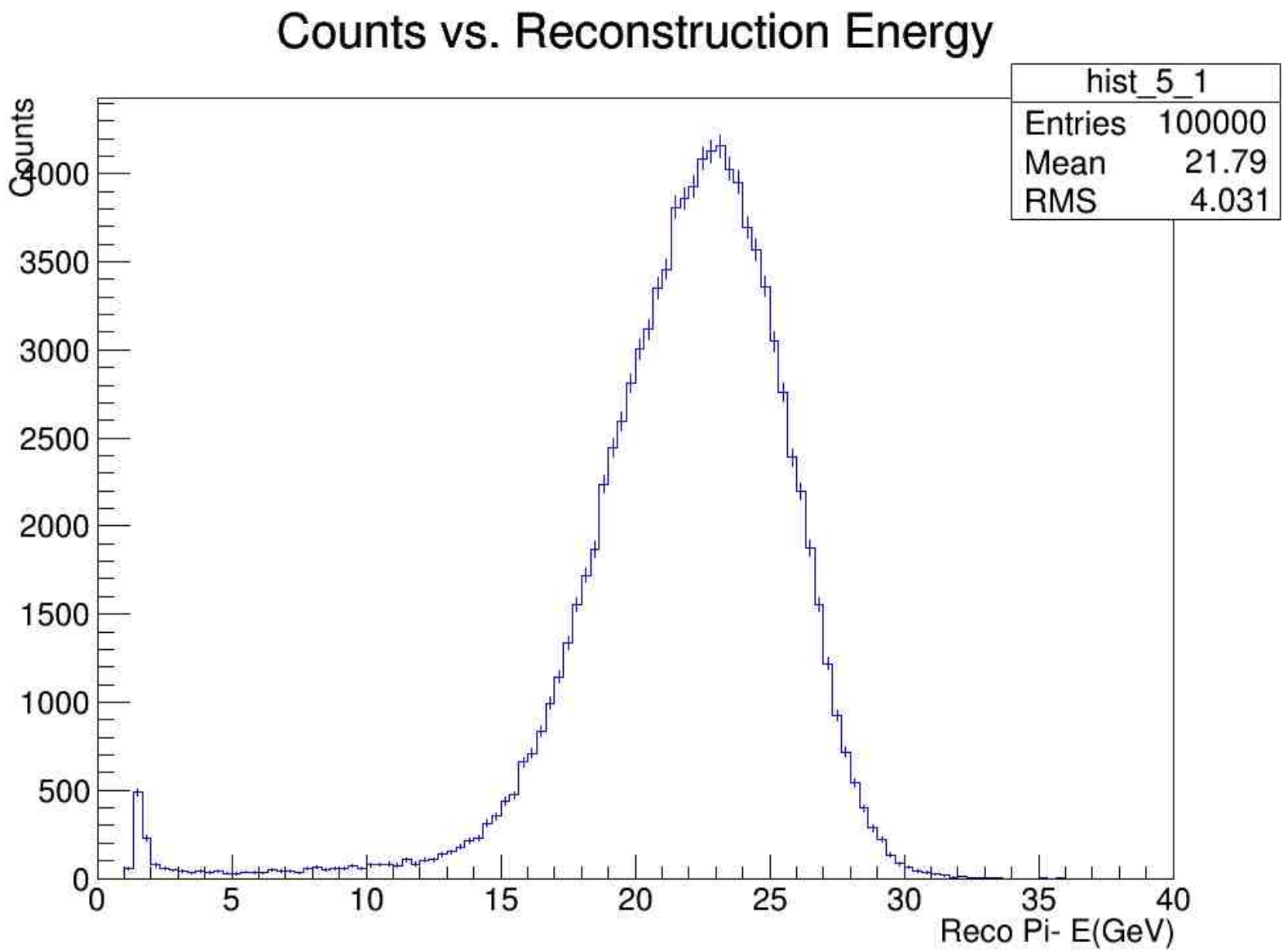


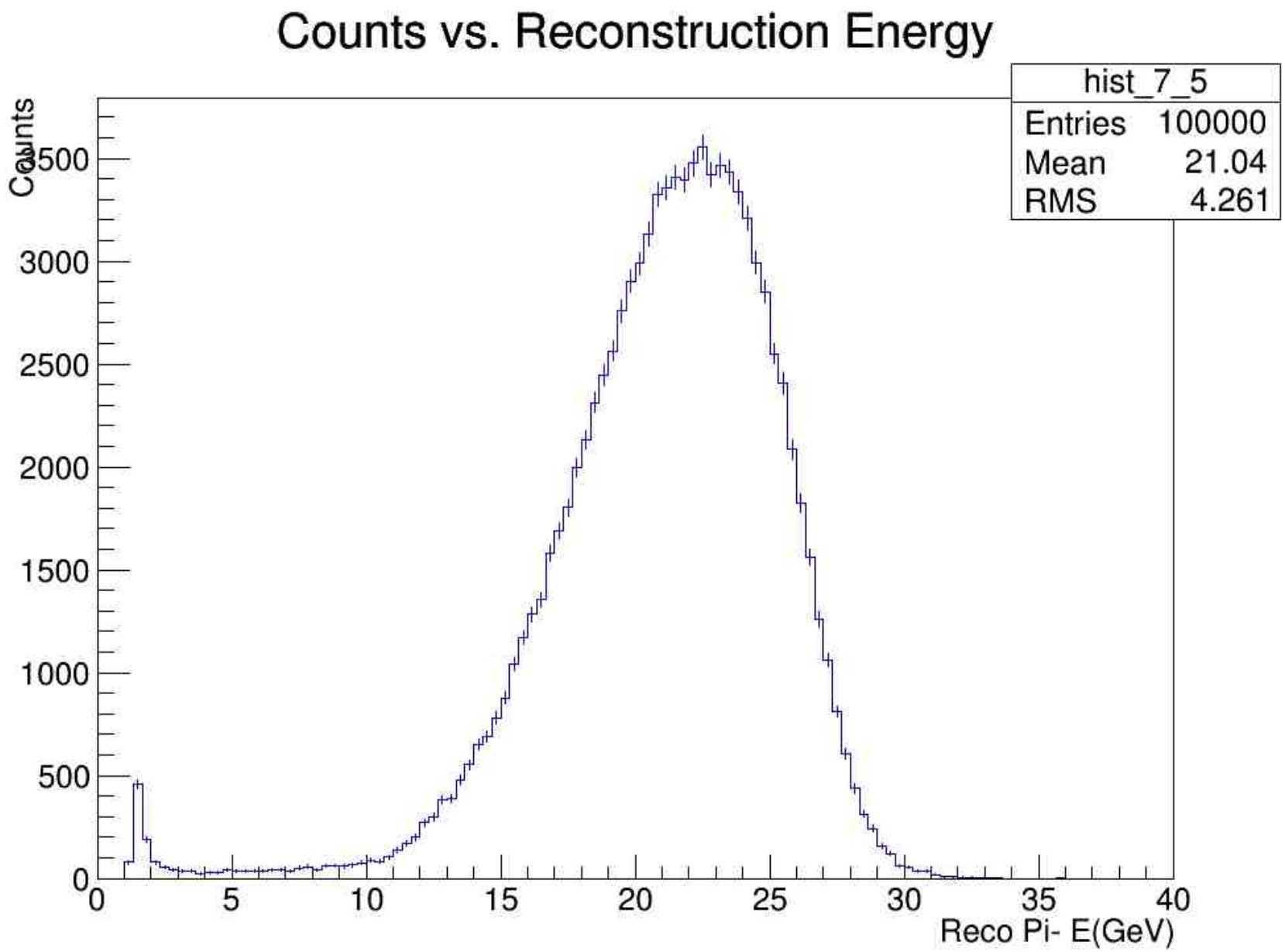
## Without Piston

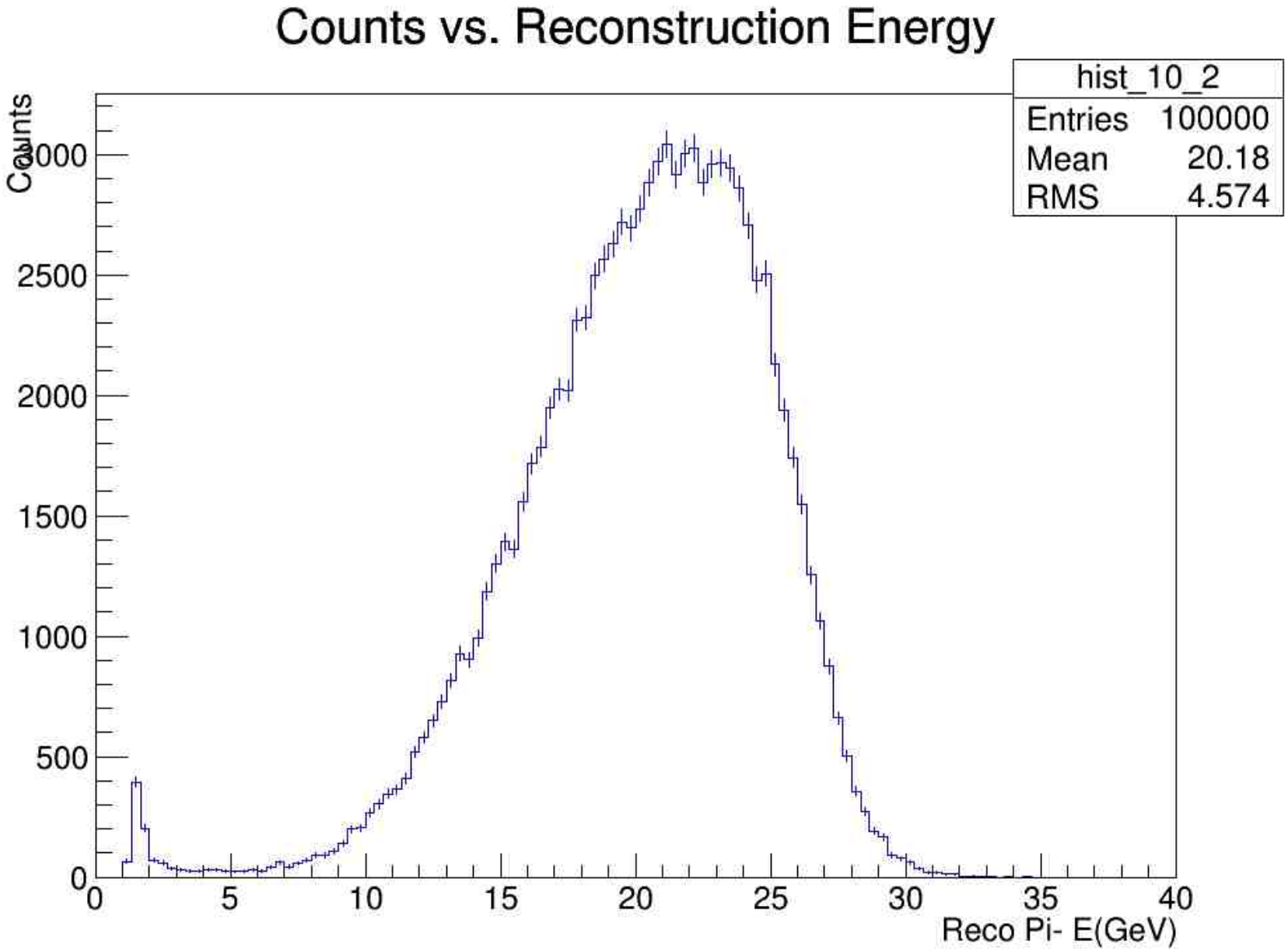


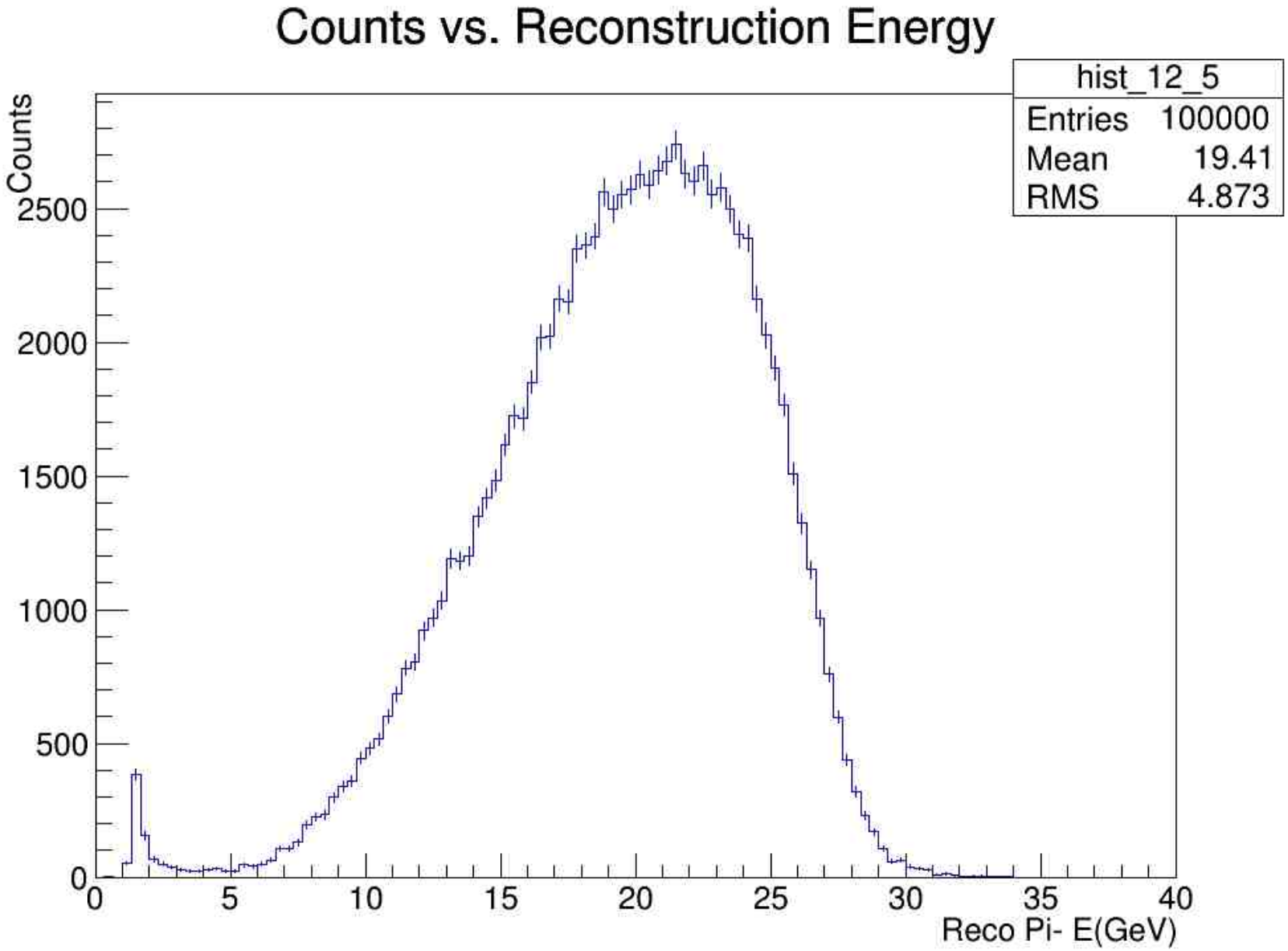

Counts vs. Reconstruction Energy
hist_0_1
Entries 100000
Mean 23.12
RMS 4.214
Counts
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

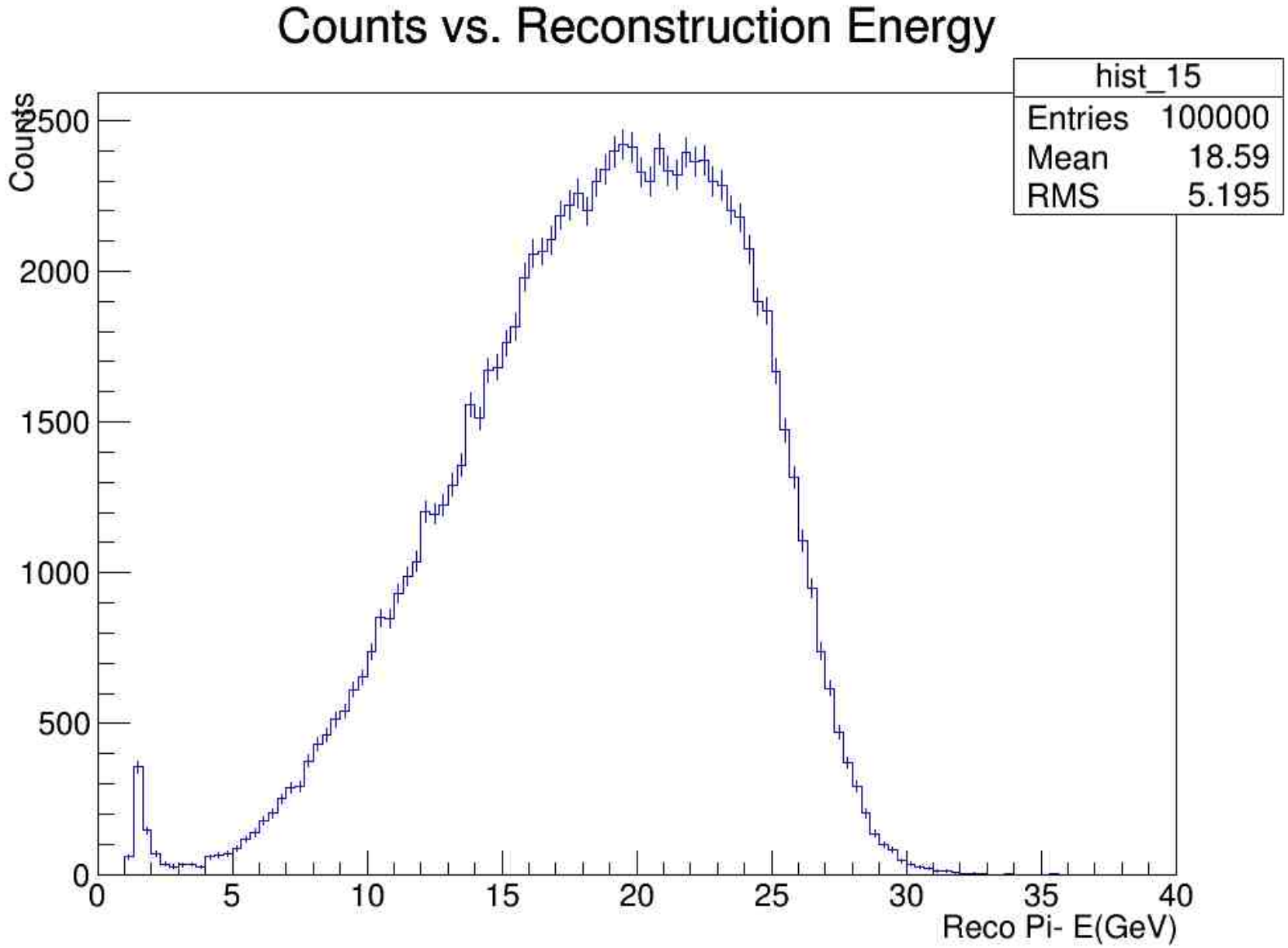

Counts vs. Reconstruction Energy
hist_2_55
Entries 100000
Mean 22.5
RMS 4.036
Counts
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

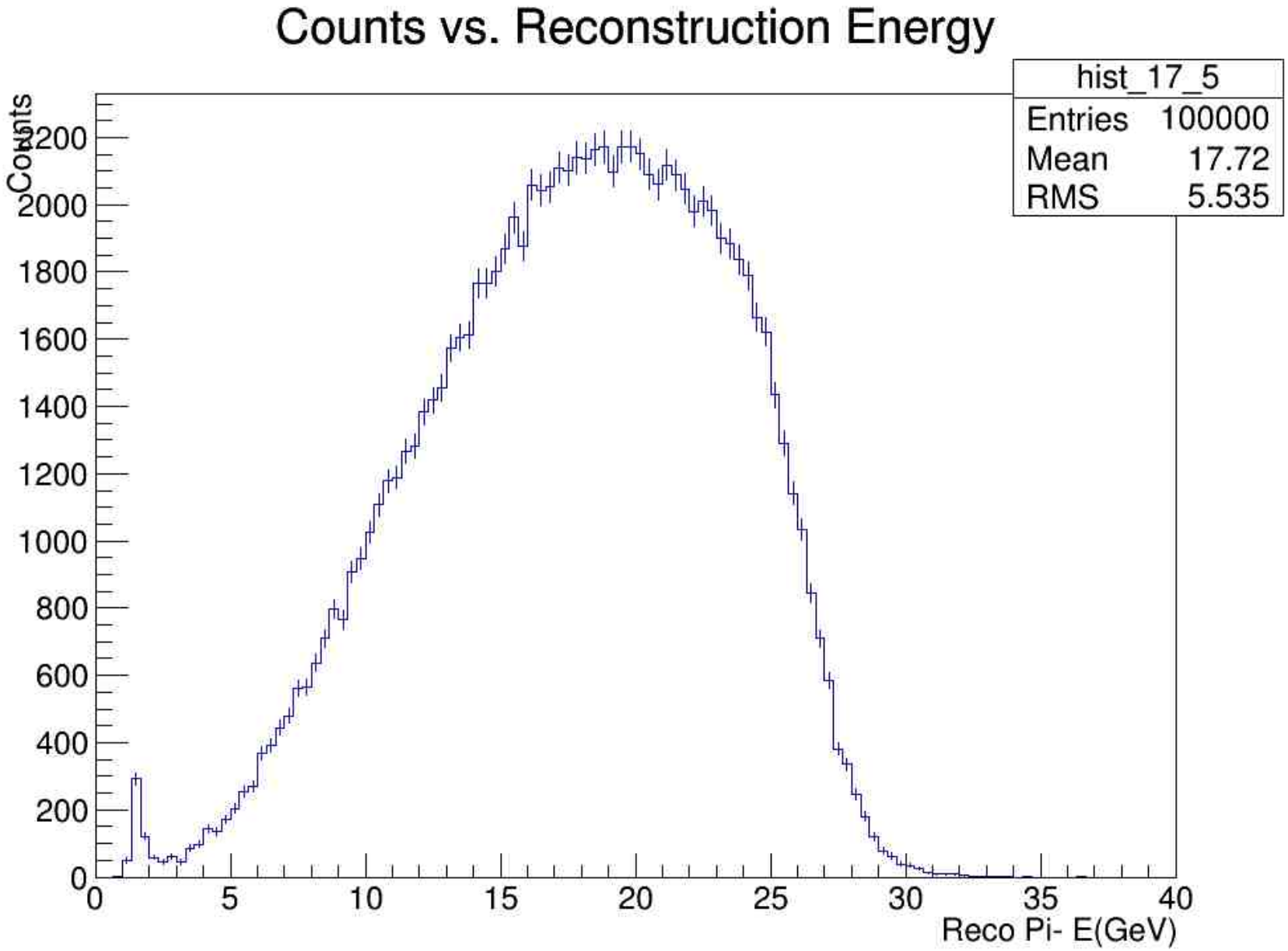

Counts vs. Reconstruction Energy
hist_5_1
Entries 100000
Mean 21.79
RMS 4.031
Counts
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

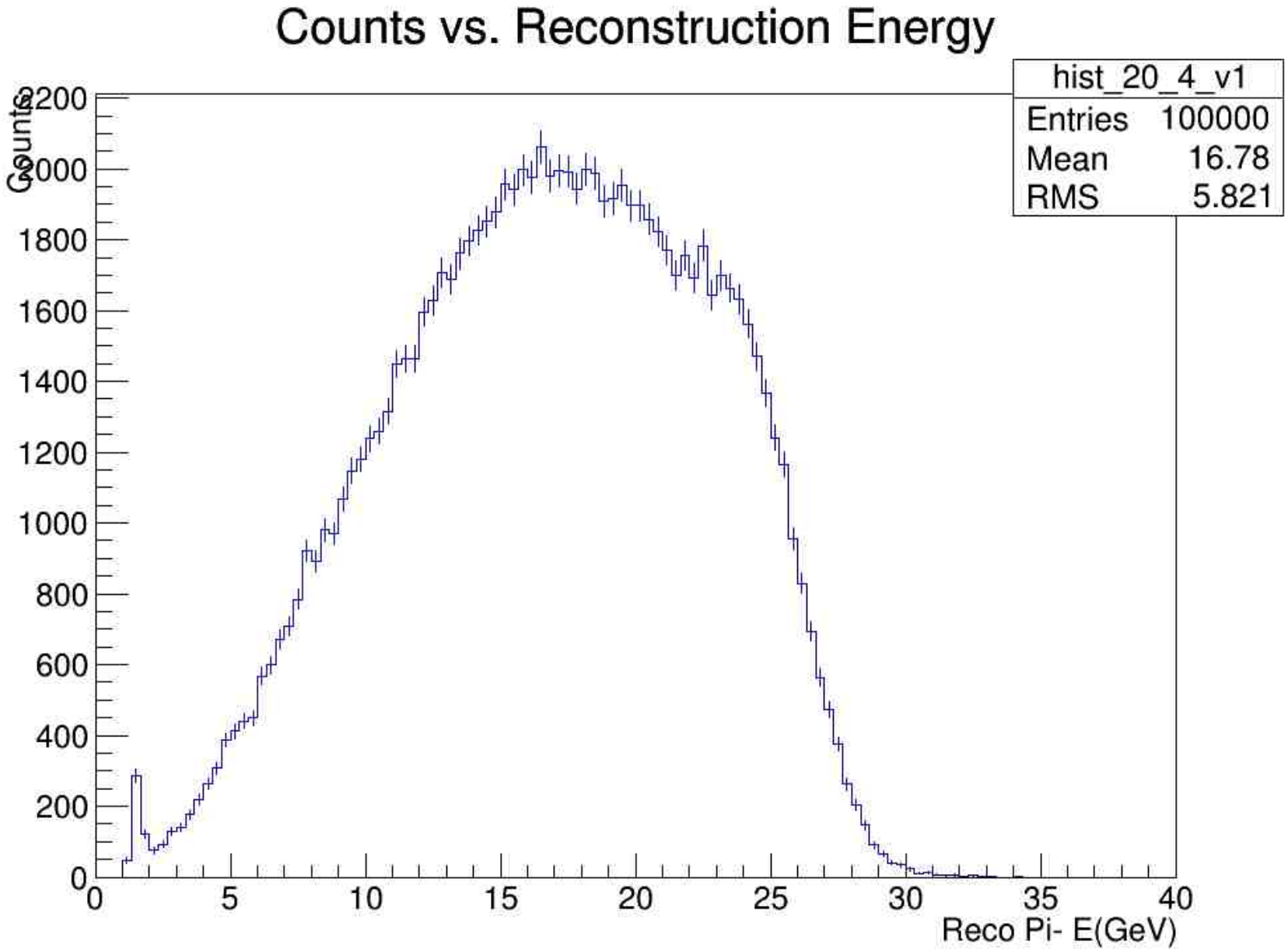

Counts vs. Reconstruction Energy
hist_7_5
Entries 100000
Mean 21.04
RMS 4.261
Counts
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

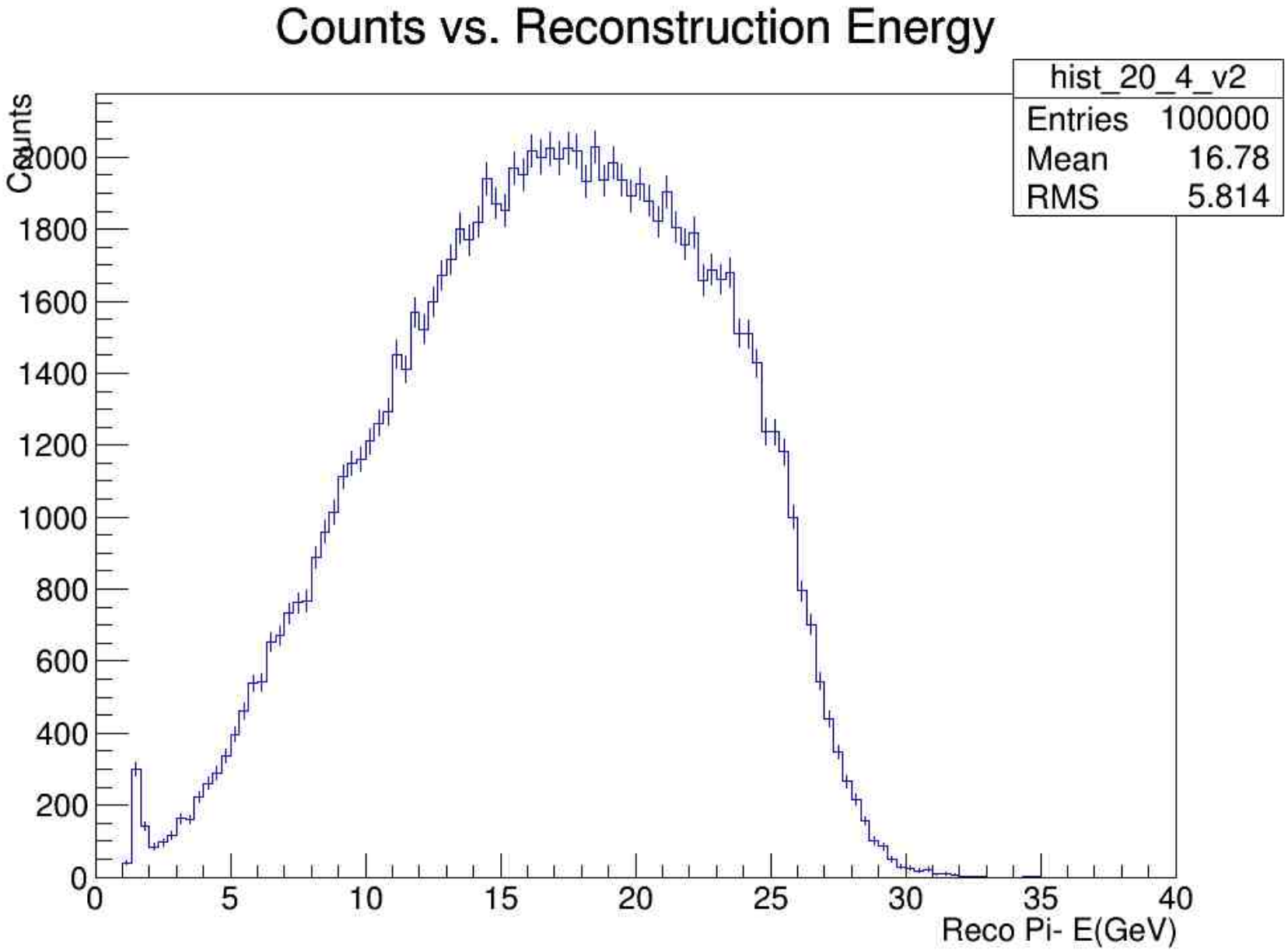

Counts vs. Reconstruction Energy
hist_10_2
Entries 100000
Mean 20.18
RMS 4.574
Counts
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

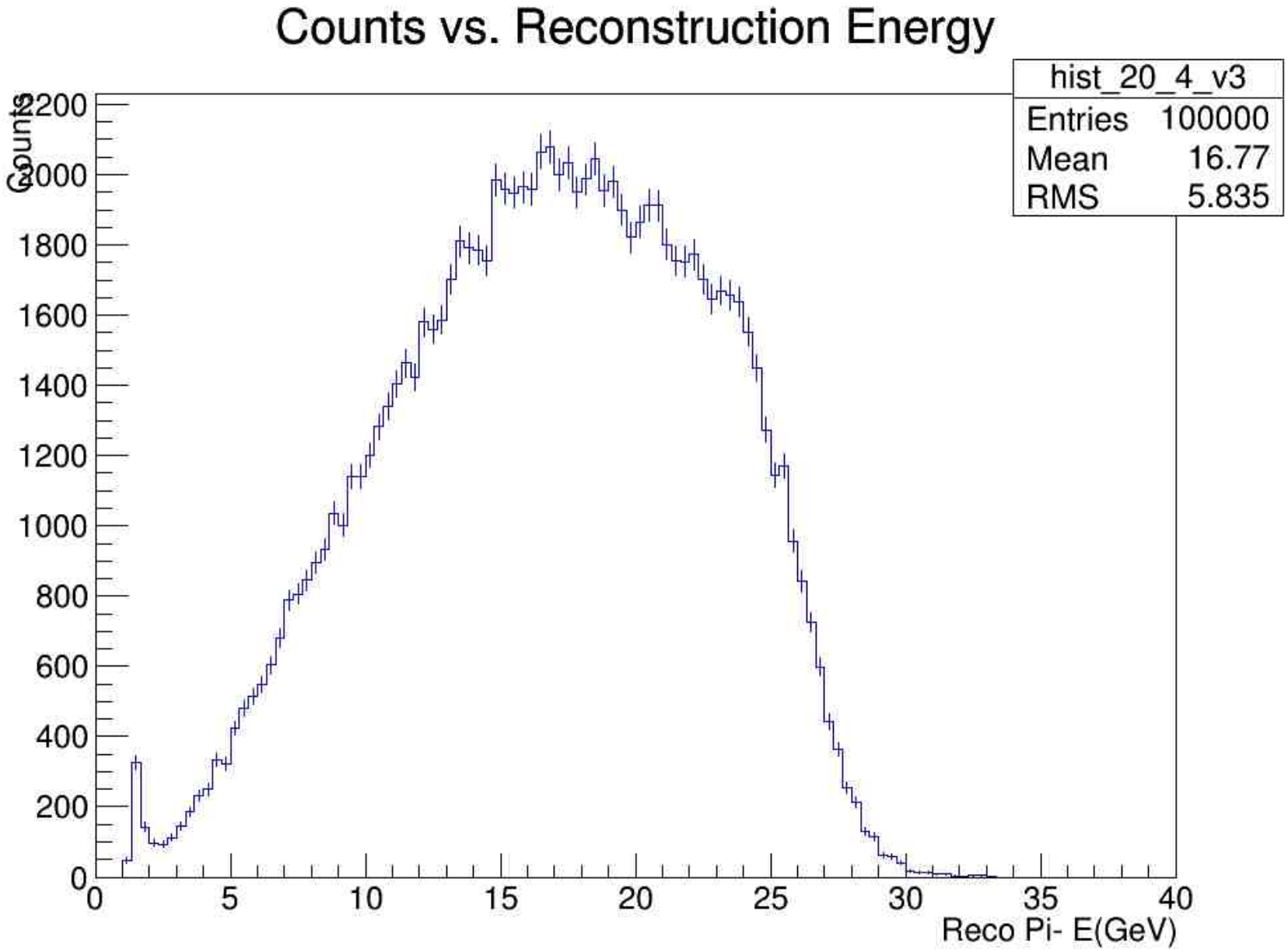

Counts vs. Reconstruction Energy
hist_12_5
Entries 100000
Mean 19.41
RMS 4.873
Counts
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

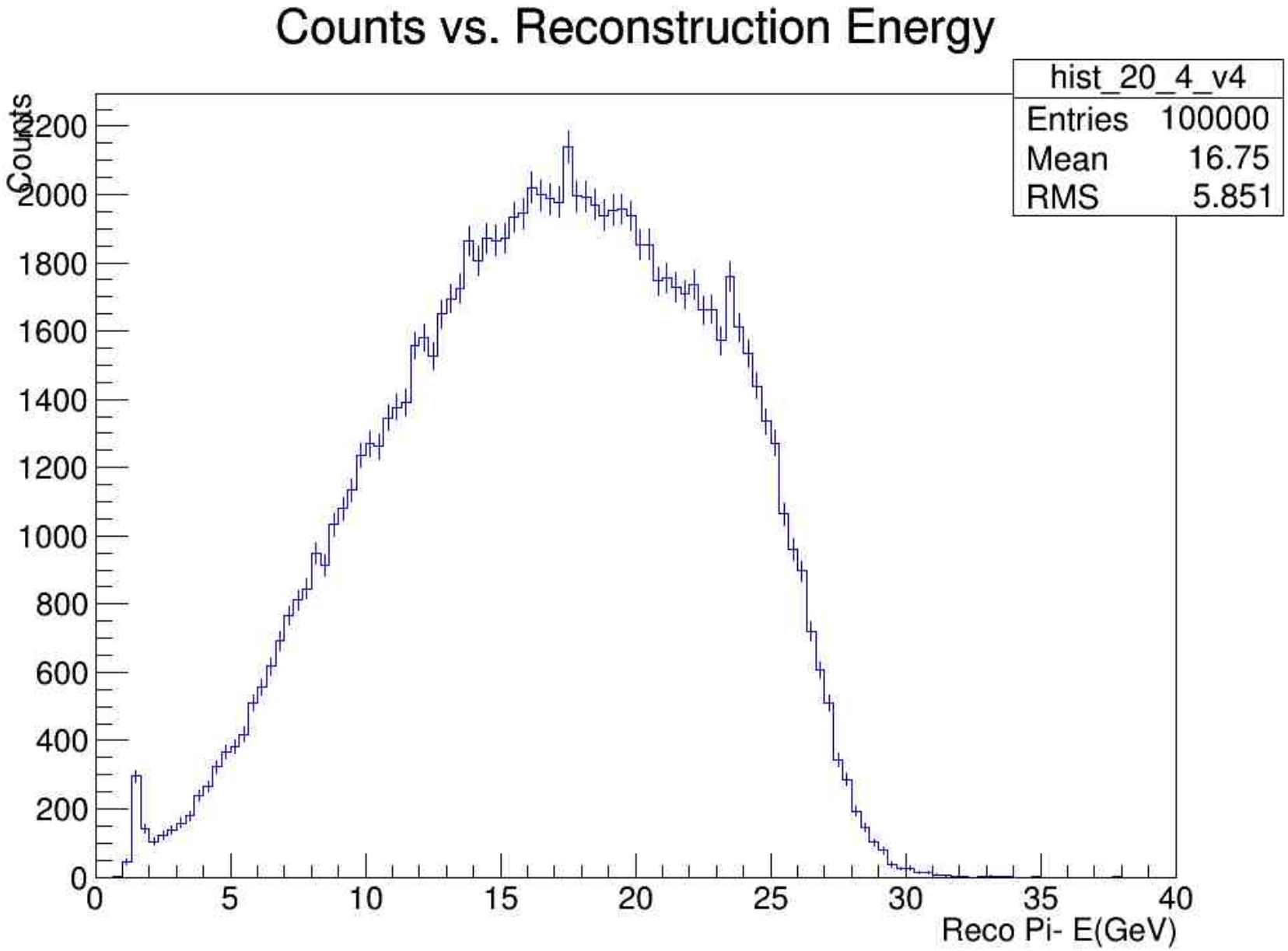

Counts vs. Reconstruction Energy
hist_15
Entries 100000
Mean 18.59
RMS 5.195
Counts
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

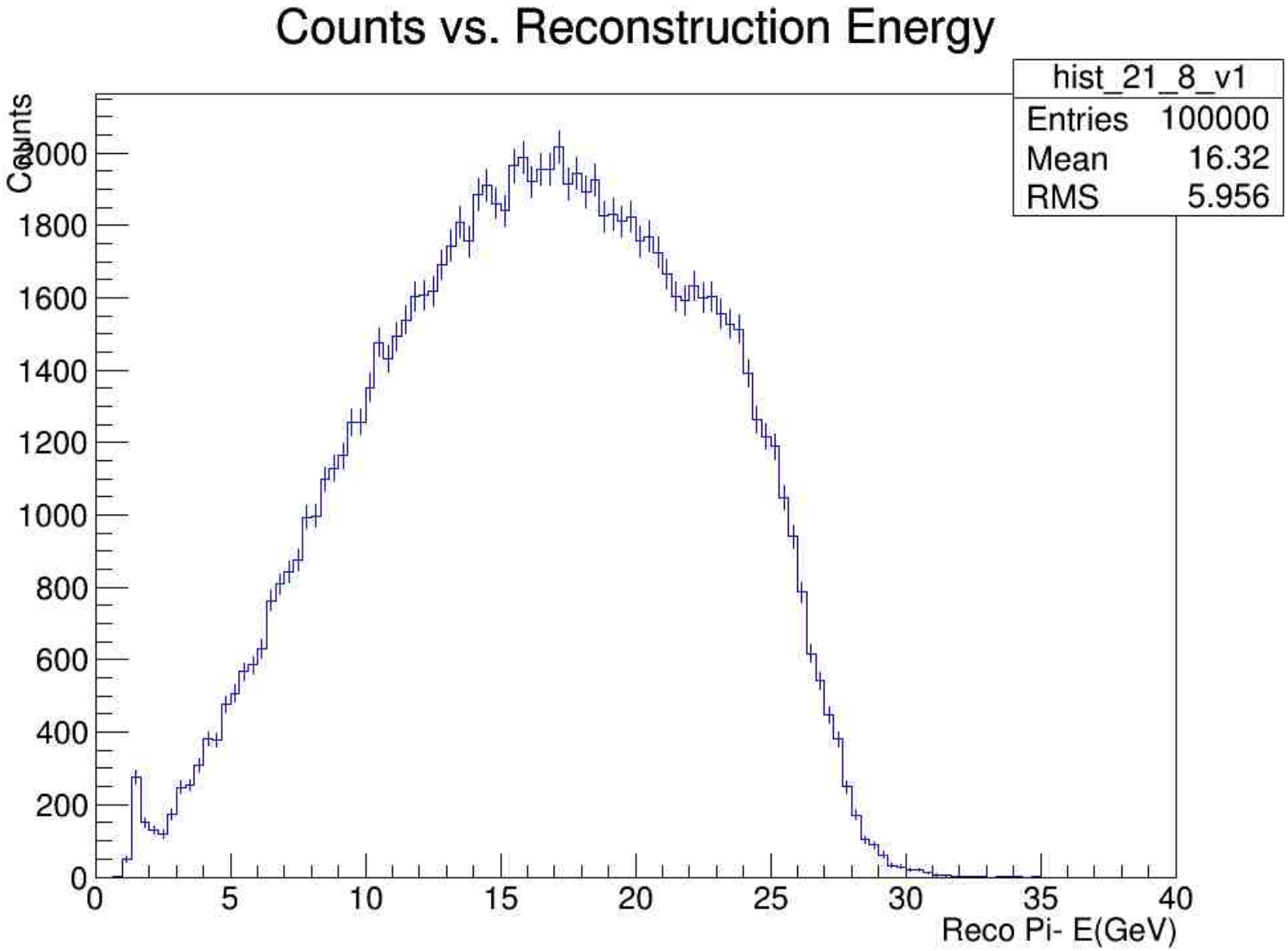

Counts vs. Reconstruction Energy
hist_17_5
Entries 100000
Mean 17.72
RMS 5.535
Counts
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)

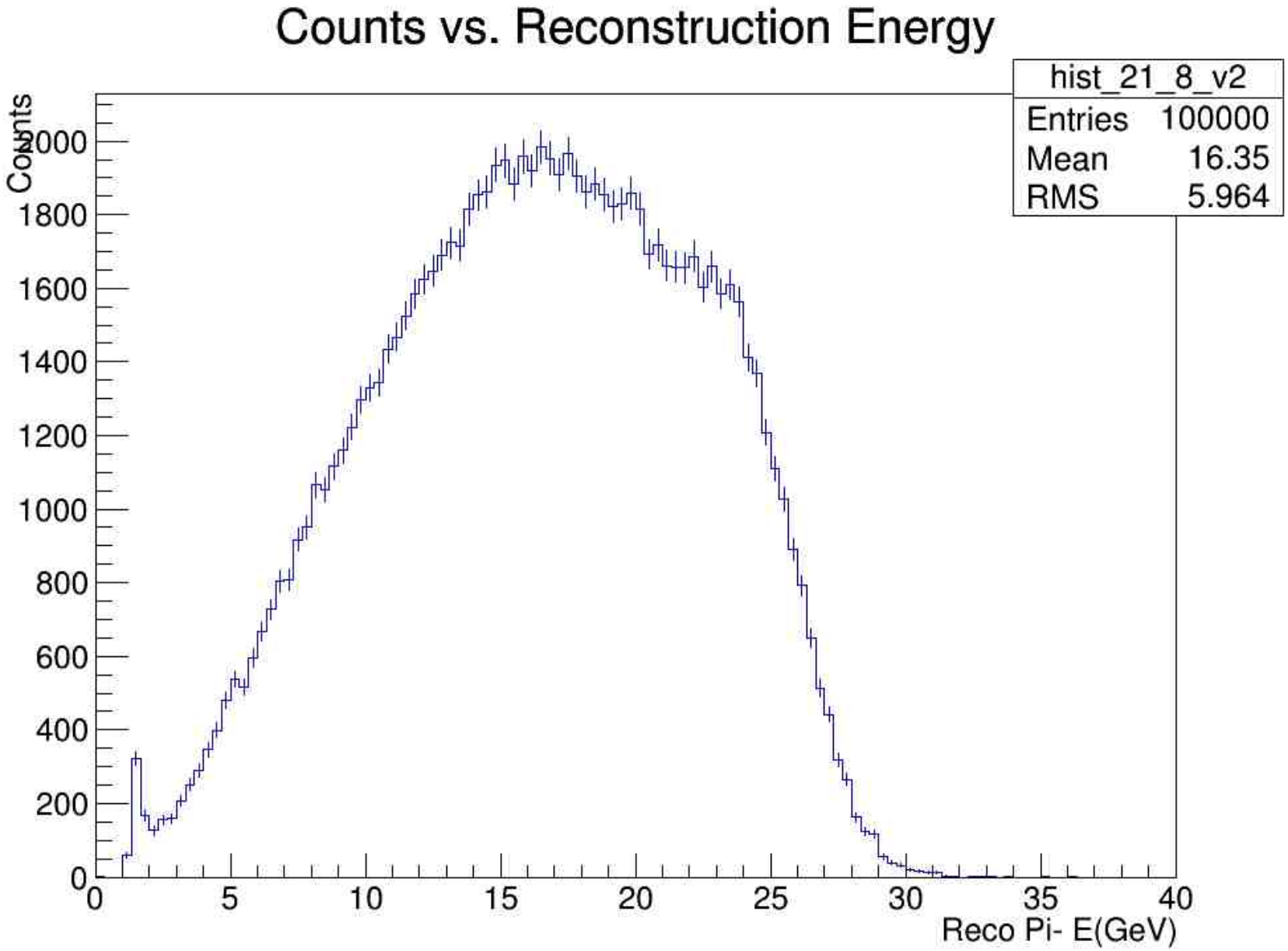

Counts vs. Reconstruction Energy
hist_20_4_v1
Entries 100000
Mean 16.78
RMS 5.821
Counts
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)


Counts vs. Reconstruction Energy
hist_20_4_v2
Entries 100000
Mean 16.78
RMS 5.814
Counts
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)


Counts vs. Reconstruction Energy
hist_20_4_v3
Entries 100000
Mean 16.77
RMS 5.835
Counts
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)


Counts vs. Reconstruction Energy
hist_20_4_v4
Entries 100000
Mean 16.75
RMS 5.851
Counts
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)


Counts vs. Reconstruction Energy
hist_21_8_v1
Entries 100000
Mean 16.32
RMS 5.956
Counts
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)


Counts vs. Reconstruction Energy
hist_21_8_v2
Entries 100000
Mean 16.35
RMS 5.964
Counts
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Reco Pi- E(GeV)